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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/706,034	11/13/2003	Kiyotaka Miyano	04329.3181	6028
22852	7590	06/17/2005	EXAMINER	
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP 901 NEW YORK AVENUE, NW WASHINGTON, DC 20001-4413			DANG, TRUNG Q	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 06/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/706,034

Applicant(s)

MIYANO, KIYOTAKA

Examiner

Trung Dang

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 March 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-4 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 5-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohuchi (US 6,762,468) in view of Ast et al. cited above and Bar-Gadda (US 6,579, 805).

The rejection is maintained as of record and repeated herein.

With reference to Fig. 6, the Ohuchi teaches method of manufacturing a semiconductor device comprising:

forming source/drain regions **20** formed in a semiconductor substrate;

forming a gate insulating film **6a** on a channel region between the source/drain regions;

forming a gate electrode **8a** made of SiGe on the gate insulating film (col. 4, lines 32-35); and

thermally oxidizing the gate electrode in an oxidation condition such that silicon in the SiGe gate electrode is selectively oxidized to form oxide sidewalls **12** (col. 4, lines 45-48).

Ohuchi differs from the claims in not disclosing that the oxidation

atmosphere contains an oxidant for selectively oxidizing Si and a reductant for reducing Ge.

Ast teaches a process in which a SiGe layer is oxidized in steam such that Si in the SiGe layer is selectively oxidized to form silicon dioxide while Ge in the SiGe layer is not oxidized (col. 5, lines 19-25; col. 6, lines 8-13; col. 4, lines 28-30; col. 8, line 50).

It would have been obvious to one having ordinary skill in the art to oxidize the SiGe gate electrode **8a** in steam as suggested by Ast because the oxidation condition set forth by Ohuchi such that silicon in the SiGe gate electrode is selectively oxidized is known in the art, and the application of a known process to achieve a desired result would have been within the level of one skilled in the art. Furthermore, Bar-Gadda discloses that steam for use in an oxidation process for producing silicon dioxide is generated by admitting H<sub>2</sub> and O<sub>2</sub> into an oxidation chamber and the H<sub>2</sub> and O<sub>2</sub> react to form steam in close proximity to the semiconductor wafer (col. 2, lines 30-39). In light of the fact shown by Bar-Gadda, it is therefore believed that H<sub>2</sub> is still present in steam to some extent because not all H<sub>2</sub> takes place in the reaction to form H<sub>2</sub>O. This fact is manifested by the result (silicon is oxidized while germanium is not) obtained in Ast's oxidation atmosphere of steam, which result is identical to that of disclosed in the pending specification. Therefore, absent evident to the contrary, Ast's oxidation atmosphere contains an oxidant (H<sub>2</sub>O) for oxidizing Si and a reductant (H<sub>2</sub>) for reducing Ge as claimed.

As for claims 11 and 15, since the oxidation atmosphere that contains H<sub>2</sub>O and H<sub>2</sub> as mentioned above produces the same result as claimed, the partial pressure ratio of H<sub>2</sub>O to H<sub>2</sub> must be inherent within the claimed range, absent evident to the contrary.

2. Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Ast et al. and Bar-Gadda, all cited above.

The admitted prior art of Fig. 26 teaches a method of manufacturing a MOS transistor comprising the steps of:

The rejection is maintained as of record and repeated herein.

forming a SiGe monocrystal channel layer including a channel region on a semiconductor substrate;

forming source/drain regions in the SiGe monocrystal channel layer formed on the semiconductor substrate;

forming a gate insulating film on the channel region between the source/drain regions; and

forming a gate electrode on the gate insulating film, wherein the gate insulating film is formed on a surface of the SiGe monocrystal layer by thermally oxidizing the SiGe monocrystal layer.

Note that, although not illustrated in the figure drawing, the admitted prior

art implies the formation of source/drains regions because the MOS transistor must have source/drain regions.

The admitted prior art differs from the claims in that while the admitted prior art forms the gate insulating film by conventional oxidation process that results in a gate oxide film containing SiO<sub>2</sub> and GeO<sub>2</sub>, the claims call for an oxidation process in an atmosphere that contains an oxidant for oxidizing Si and a reductant for reducing Ge so that the gate insulating film is made of substantially silicon oxide.

Ast teaches a process in which a SiGe layer is oxidized in steam such that Si in the SiGe layer is selectively oxidized to form silicon dioxide while Ge in the SiGe layer is not oxidized (col. 5, lines 19-25; col. 6, lines 8-13; col. 4, lines 28-30; col. 8, line 50).

It would have been obvious to one having ordinary skill in the art to modify the admitted prior art by oxidizing the SiGe channel layer in steam as suggested by Ast because the oxidation condition set forth by Ast would produce a gate insulating film contains only SiO<sub>2</sub>. The absence of GeO<sub>2</sub> would prevent damage imposed on the gate insulating film due to the dissolve of GeO<sub>2</sub> in H<sub>2</sub>SO<sub>4</sub> usually used in subsequent process. In addition, Bar-Gadda discloses that steam for use in an oxidation process for producing silicon dioxide is generated by admitting H<sub>2</sub> and O<sub>2</sub> into an oxidation chamber and the H<sub>2</sub> and O<sub>2</sub> react to form steam in close proximity to the semiconductor wafer (col. 2, lines 30-39). In light of the fact shown by Bar-Gadda, it is therefore believed that H<sub>2</sub> is still present in steam to some extent because not all H<sub>2</sub> takes place in the reaction to form H<sub>2</sub>O. This fact is manifested by the result (silicon is

oxidized while germanium is not) obtained in Ast's oxidation atmosphere of steam, which result is identical to that of disclosed in the pending specification. Therefore, absent evident to the contrary, Ast's oxidation atmosphere contains an oxidant (H<sub>2</sub>O) for oxidizing Si and a reductant (H<sub>2</sub>) for reducing Ge as claimed.

As for claim 18, since the oxidation atmosphere that contains H<sub>2</sub>O and H<sub>2</sub> as mentioned above produces the same result as claimed, the partial pressure ratio of H<sub>2</sub>O to H<sub>2</sub> must be inherent within the claimed range, absent evident to the contrary.

### ***Response to Arguments***

3. Applicant's arguments filed 3/29/05 have been fully considered but they are not persuasive.

Primarily applicants argue that the Examiner fails to establish a prima facie case of obviousness. The Examiner disagrees for the following reasons:

The Examiner recognizes the references cannot be arbitrarily combined and there must be some logical reason as to why one skilled in the art would be motivated to make the proposed combination of references. And the test for combining references is what the combination of disclosures taken as a whole would suggest. Following these guidelines in evaluating facts disclosed in the references which will be addressed below, the Examiner believes that a prima facie case of obviousness has been established.

a) Reference to Ohuchi: teaches thermally oxidizing the gate electrode in an oxidation condition such that silicon in the SiGe gate electrode is selectively oxidized

(i.e. Si is oxidized but not Ge). Ohuchi is silent as to what oxidation condition is employed in the oxidation process.

b) Reference to Ast: teaches steam is an oxidation condition in which SiGe is selectively oxidized to form silicon dioxide while Ge in the SiGe layer is not oxidized (col.5, lines 19-25; col. 6, lines 8-13; col. 4, lines 28-30; col. 8, line 50)

Thus, in light of the facts presented in a) and b), one of ordinary skill in the art would take no effort to recognize that in order to achieve Ohuchi's selective oxidation, the oxidation condition must be steam. Therefore, the proposed combination is a prima facie case of obviousness because the realization of employing a known technique to achieve the same purpose (i.e. selective oxidation) would have been well within the level of an artisan. As for the issue of common knowledge, it is well settled that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art (emphasis added). See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

c) Reference to Bar-Gadda: this reference is used to show the fact that steam for use in an oxidation process is generated by admitting H<sub>2</sub> and O<sub>2</sub> into an oxidation chamber and the H<sub>2</sub> and O<sub>2</sub> react to form steam. The wet oxidation process for producing SiO<sub>2</sub> according to the reaction: Si + H<sub>2</sub>O -> SiO<sub>2</sub> + H<sub>2</sub> (col. 2, lines 30-39).



Evidently,  $H_2$  is produced by the reaction and therefore present in the oxidation atmosphere. Thus, Bar-Gadda's reference is a factual evidence showing the fact the oxidation atmosphere of steam of combined process of Ohuchi and Ast contains both oxidant ( $H_2O$ ) and reductant ( $H_2$ ).

As for applicants' request the Examiner to provide explicit basis on which the Examiner regards the matter as subject to official notice and allow applicant to challenge in the next reply after the Office action, it is noted that the Examiner did not use official notice (assertion by the Examiner without providing reference) in the rejection but rather providing applicants with references along with rationales as to why one skilled in the art would be motivated to combine references as clearly presented above. Therefore, the Examiner's obligation is moot.

### ***Conclusion***

**4. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Trung Dang  
Primary Examiner  
Art Unit 2823

06/13/05